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NEW RECORDS OF SUBFAMILIES, TRIBES AND GENERA OF BRACONIDAE (INSECTA: HYMENOPTERA) FROM AUSTRALIA, WITH DESCRIPTION OF SEVEN NEW SPECIES

by A. D. AUSTIN* & R. A. WHARTON**

Summary

AUSTIN, A. D. & WHARTON, R. A. (1992) New records of subfamilies, tribes and genera of Braconidae (Insecta: Hymenoptera) from Australia, with description of seven new species. *Trans. R. Soc. S. Aust.* **116**(2), 41–63 29 May, 1992.

Three subfamilies of Braconidae are recorded from Australia for the first time with the description of the following new species from Queensland: *Ecnomios stenosoma* sp. nov. (Ecnomiinae), *Histeromerus clavatus* sp. nov. (Histeromerinae), and *Meteorideus unic* sp. nov. (Meteorideinae). The tribe Muesebeckiini is also specifically recorded from Australia for the first time with the description of *Paroligoneurus pallidus* sp. nov. (Ichneutinae) from the Northern Territory, Queensland and New South Wales, as is the genus *Chrysopophthorus* Goidanich, with the description of *C. hageni* sp. nov. (Euphorinae) from South Australia. A new species of the Australian endemic subfamily Mesostoinae from South Australia and Victoria, *Mesostoa kerri* sp. nov., is described, as is a new species of the little known genus *Calohelcon* Turner (Helconinae) from central Australia, *C. dangerfieldi* sp. nov. The diagnoses, biogeography and biology of these taxa are discussed and notes are provided on the euphorine genus *Stenothremma* Shaw, previously thought to be rare within the Australian fauna. Keys to species are provided for the genera *Histeromerus* Wesmael, *Mesostoa* van Achterberg and *Calohelcon* Turner.

KEY WORDS: Hymenoptera, Braconidae, Ecnomiinae, Histeromerinae, Meteorideinae, Euphorinae, Helconinae, Mesostoinae, Ichneutinae, Muesebeckiini, new species.

Introduction

The Braconidae is one of the largest families of parasitic Hymenoptera. Its members are ecto- and endoparasitoids of a wide range of insect hosts, in particular larval stages of Lepidoptera, Coleoptera and Diptera. Although the family has been extensively studied elsewhere, the fauna of Australia remains poorly known, despite the existence of a relatively large number of endemic subfamilies and genera. Indeed, the majority of subfamilies in Australia have not been revised, and most genera and species are known only from their original early descriptions (the majority described prior to the 1920's). Recent taxonomic work undertaken by us on the Microgastrinae and Alysiinae (Austin & Dangerfield 1992; Wharton in prep.) indicates that for these two subfamilies less than 10% of Australian species are described, and this is likely to be the general situation across the whole family. Until the Braconidae are better surveyed at the generic level, questions regarding the evolution and biogeography of the Australian fauna cannot begin to be addressed. Here we make a contribution in this regard by reporting on a number of significant taxa that were discovered when sorting material in major Australian collections, in particular the Australian National Insect Collection, Canberra and the Department of Primary Industries Collection, Brisbane. Seven species are newly described, three representing the first record from Australia of the subfamilies Ecnomiinae, Histeromerinae and Meteorideinae, and one representing the first description of an Australian species from the ichneutine tribe, Muesebeckiini. The relationships, diagnoses and biogeography of all taxa are discussed and notes are provided on their biology where available. Keys to species are provided for the genera *Histeromerus* Wesmael, *Mesostoa* van Achterberg and *Calohelcon* Turner.

Abbreviations for collections are: AEIC, American Entomological Institute, Gainesville; ANIC, Australian National Insect Collection, Canberra; BMNH, The Natural History Museum, London; CNCI, Canadian National Collection, Ottawa; HNHM, Hungarian Natural History Museum, Budapest; QDPI, Queensland Department of Primary Industries, Brisbane; RMNH, Rijksmuseum van Natuurlijke Historie, Leiden; TAMU, Texas A & M University, College Station; USNM, United States National Museum, Washington, D.C.; WARI, Waite Agricultural Research Institute, Adelaide. Terminology for morphology and sculpturing pattern follow Gauld & Bolton (1988) and Wharton (1977, 1986), respectively, while that for venation follows van Achterberg (1979).

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Treatment of species

Subfamily Ecnomiinae van Achterberg

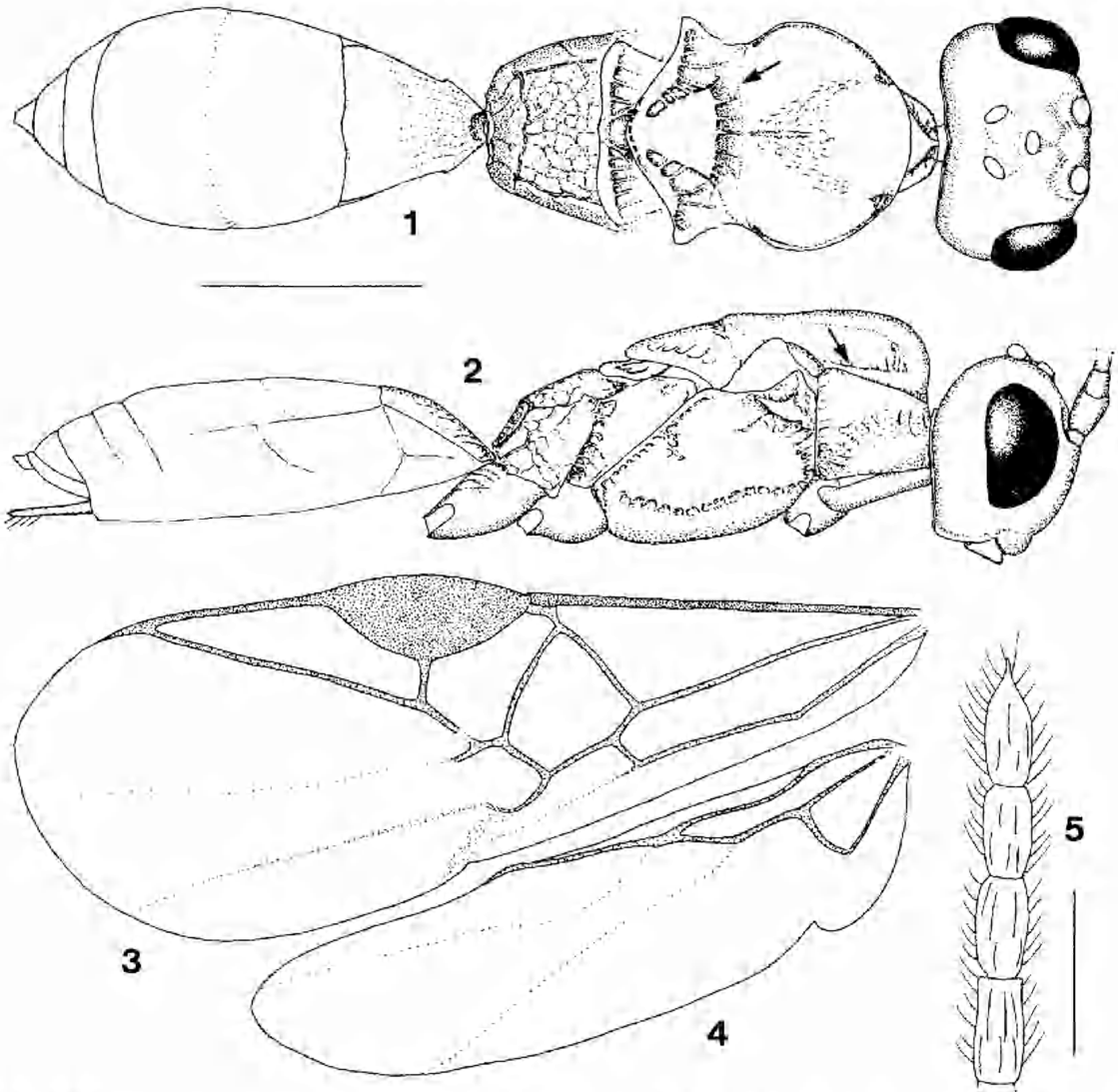
Comments: The systematic position of the only included genus, *Ecnomios* Mason, has been the subject of some debate. Mason (1979) noted its superficial resemblance to Microgastrinae, but excluded it on the basis of the sclerotised distal radial sector of the fore wing and the arrangement of abdominal spiracles. Mason (1979) emphasized seven other characters which suggested a relationship with *Orgilus* Haliday, and thus included *Ecnomios* in the Orgilinae. Van Achterberg (1985, 1988) put *Ecnomios* in its own subfamily, and suggested that it is best placed halfway between Cheloninae and Neoneurinae. Van Achterberg (1985) excluded *Ecnomios* from the Orgilinae because "the Orgilinae lack vein 1-SR of fore wing, have marginal cell long and rather narrow, presence of vein CU1b of fore wing, convex face, large hind coxae, and small plical lobe of hind wing". The face is actually as convex in *Ecnomios* as it is in many *Orgilus*. The remaining features are as suitable for arguing against a relationship between *Ecnomios* and Cheloninae as they are for arguing against the relationship between *Ecnomios* and Orgilinae. Furthermore, *Ecnomios* lacks three of the four synapomorphies proposed by van Achterberg (1984) for the Cheloninae-Microgastrinae lineage. The placement of *Ecnomios* is thus still unsettled, as noted by Quicke & van Achterberg (1990). We prefer to treat it provisionally as intermediate between Orgilinae and the cheloniine-microgastrine lineage based largely on wing venation patterns. However, the presence of a transverse postscutellar plate in the species described below opens up the possibility for relationships with the Blacinae and Euphorinae, where similarly reduced venation occurs.

Mason (1979) and van Achterberg (1985) provide detailed lists of characters defining and differentiating *Ecnomios*. The material available to us, representing at least four species, largely conforms with the original description and redescription, but there are important exceptions. The following remarks are therefore provided to supplement previously published information. Maxillary palps are interspecifically variable, either 4- or 5- segmented. Antennal segments are also variable in number both intra- and interspecifically, most flagellomeres have placodes in two ranks, and the apical flagellomere is spinose at the tip. Although van Achterberg (1985) states that the apical antennal segment lacks an apical spine, Mason (1979) correctly notes that it is acutely pointed (Fig. 5), and this is true for all species examined.

Van Achterberg (1985) described the pronotum dorsally as having a large, deep, transverse pronope. However, this is not the same structure as the isolated pit found, for example, in some species of opiines, alysiines, and rogadines. It is actually part of a complex series of pits or depressions forming a crenulate sulcus which separates a weakly raised posterior median area from weakly raised antero-lateral areas (Fig. 1). There is considerable variation in pronotal sculpture and the pattern should prove useful in defining species or species-groups. Both Mason (1979) and van Achterberg (1985) described a conspicuous projection in the middle of the antero-lateral margin of the pronotum (in lateral view). This feature, though very well developed in *E. papuensis* Mason, is weak or virtually absent in some other species, and is thus of questionable value for generic or subfamily characterisation. In *Ecnomios* the "projection" is actually the ventral portion of an indentation in the thin, anterior margin of the pronotum. The occipital carina fits into this indentation when the head is retracted. The structure is thus different in both appearance and function from the angular projection of the margin seen in some species of *Orgilus*.

The carinate antero-lateral margin of the mesonotal disc has some potential for characterising higher taxa if accurately described. Mason (1979) correctly notes its presence in the type species, but van Achterberg (1985) claims that it is absent in front of the tegula. It is well developed and complete from the base of the notauli to well past the tegula in all Australian species we examined (Fig. 2, arrowed). The transscutal articulation (Fig. 1, arrowed) is also distinct along the anterior margin of the scuto-scutellar sulcus in all species, but indistinct laterally. In *E. papuensis*, the scutellum lacks a median postscutellar plate (transverse scutellar depression *sensu* van Achterberg). In the species described below, however, a small one is present similar in shape and position to that in *Sigalphus bicolor* Cresson and some Centistini. The bicarinate median portion of the metanotum is also similar to that of sigalphines and many centistines, but this pattern is repeated in several other braconid subfamilies. A broad propodeal areola is present posteriorly in all species, but variously shaped, and often largely obscured by rugose sculpture. Mason (1979) noted ridges on the dorsal surface of the hind coxa in his description of *E. papuensis*. All species have at least a single ridge in this position, suggesting a synapomorphy for the genus. The venation of the short, broad fore and hind wings (Figs 3, 4) is also diagnostic for *Ecnomios*, has been adequately characterised by previous authors, and is essentially uniform in all species. 1-SR varies in length among species, and its presence may not be sufficiently reliable for subfamilial diagnosis.

The new species described below is a predictable range extension for *Ecnomios* from Papua New Guinea into northern Queensland. We have had an opportunity to examine a single female from Somalia (CNCI)



Figs 1–5. *Ecnomios stenosoma* sp. nov., ♀ holotype. 1, dorsal view of body (transscutal articulation, arrowed); 2, lateral view of body (carinate antero-lateral margin of mesonotal disc, arrowed); 3, fore wing; 4, hind wing; 5, distal flagellomeres of antenna. Scales: Figs 1–4 = 0.5 mm; Fig. 5 = 125 μm.

representing an undescribed species and seven specimens from Queensland and Northern Territory (ANIC), which differ primarily in colour from *E. papuensis* and the species described below. Based on this distribution pattern, *Ecnomios* should eventually be found in India as well as other Indo-Australian localities.

Ecnomios stenosoma sp. nov.
FIGS 1–5

Material examined. Holotype: ♀, ANIC, Queensland, "15 16 S 144 59 E 14 km W by N of Hope Vale Mission Q 7-10 May 1981 I. D. Naumann ex ethanol". Paralypes: Queensland, 3 ♀♀, Rex Range Lookout, via Julatten, 16°30′S, 145°25′E, 9.xi-2.xii.1981, malaise trap (QDPI); 1 ♀, 1 ♂, 15°03′S, 145°09′E, 3 km NE Mt Webb, 1-3.x.1980, J. C. Cardale, ex ethanol, collected at light (ANIC, TAMU); 1 ♂, 15°47′S, 145°14′E, Shiptons Flat, 16-18.v.1981, I. D. Naumann, ex ethanol (WARI); 1 ♂, 17°41′S, 145°26′E, Millstream Falls Nat. Pk, 24-25.v.1980, I. D. Naumann & J. C. Cardale, ex alcohol collection (TAMU).

Female

Head. 1.05–1.15 broader than mesonotum (between tegulae); face 1.45–1.60 × wider than high; malar sulcus restricted to a weak impression extending less than half distance from eye to mandible; malar space

about 2 × basal width of mandible; mandibular teeth minute, dorsal tooth nearly 2 × longer than ventral tooth; clypeus with shallow widely spaced punctures; head otherwise largely smooth and polished, with fine hair-punctures; ocelli similar to *E. papuensis*, though lateral ocelli slightly more distant from eyes; antenna 28- to 30-segmented.

Mesosoma. 1.85–2.05 × longer than high; width between tegula 0.95–1.15 × height; pronotum in dorsal view with thin medially emarginate anterior border and small posterior median plate and transverse crenulate sulcus curving anteriorly in front of median plate; indentation and associated angular protrusion along antero-ventral margin of pronotum weak, barely evident in some specimens; lateral margin of mesonotal disc sharply carinate, the sculpture extending from base of notauli beyond tegula to posterior margin of basal wing pad; disc uniformly and densely short-setose and finely punctate; notauli narrow, very shallow, crenulate-rugulose, converging posteriorly to form a large crescent-shaped, rugulose patch as in *E. papuensis*; apical margin of scutellum sculptured medially (Fig. 1) giving the appearance of a transverse postscutellar plate; scuto-scutellar sulcus, parascutellar fields, metanotum, mesopleuron and metapleuron as in *E. papuensis*, but with slightly weaker sculpture; anterior portion of propodeum rugulose, median longitudinal carina usually absent, lateral longitudinal carinae usually weak, sometimes almost indistinguishable amongst background sculpture, smaller posterior declivous portion more finely sculptured, marked anteriorly by broadly bowed transverse carina; hind coxa shorter than petiole, with a strong diagonal carina dorsally extending nearly from base to apex and with 1-2 shorter weaker carinae adjacent to this.

Fore wing. (Fig. 3) As for *E. papuensis* except as follows: 2-1-3 M variable, short as in *E. papuensis* in one paratype but approximately equal in length to 2SR+M in other specimens; 1SR+M arising from 1-M near parastigma, with 1-SR nearly absent in several specimens; 2-CU1 2.20±0.35 × longer than 3-CU1; 2-1A often represented by a short tubular spur at extreme base, otherwise almost completely indistinguishable.

Metasoma. Petiole with length slightly shorter than (0.75–0.85 ×) apical width; metasoma shape, sculpture, and setal patterns otherwise as in *E. papuensis*.

Colour. Light yellow-brown; ocellar triangle, most of T2-4-5 and at least apical margins of subsequent terga darker than rest of body; scutellar region often suffused with brown; antenna and apices of 5th tarsal segments brown; mouthparts white, except for tip of mandible which is reddish.

Length. 2.2–2.4 mm.

Male

Essentially as for female except ocellar field and petiole possibly a little broader, but insufficient material for adequate comparison.

Biology. Unknown.

Diagnosis: This species is readily identified on the basis of its pale coloration. Both *E. papuensis* and an undescribed species from Queensland are largely dark brown to black. *E. stenosoma* also has a narrower body, with the head somewhat broader than the mesonotum. The mesonotum is broader than the head in *E. papuensis*.

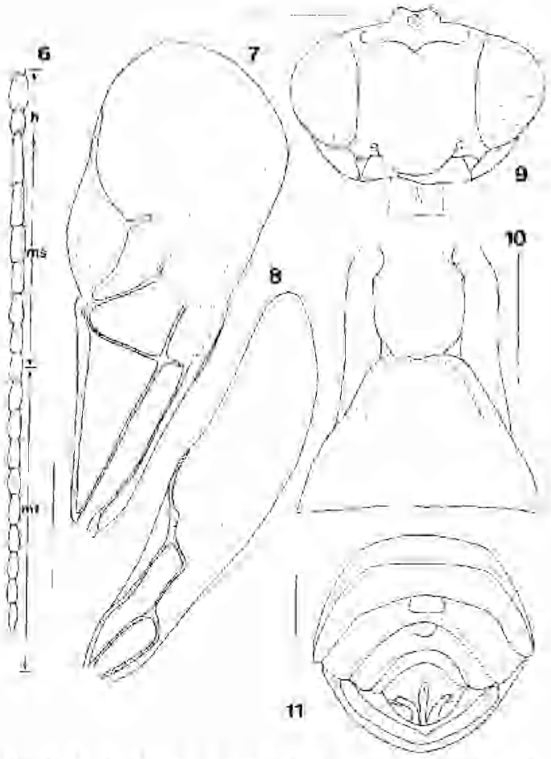
Subfamily Ichneutinae Foerster
Tribe Muesebeckiini Mason

Comments. Mason (1969) placed this tribe in the Ichneutinae. He included six genera, three of which were transferred from the Microgastrinae. This placement was overlooked by Shenefelt (1973) but accepted by other workers (e.g. Marsh 1979; van Achterberg 1984) except Tobias & Belokobylskij (1981), who later transferred the Muesebeckiini to the Miracinae on the basis of host relationships and similarity in reductions of venation, palp segments, and male genitalia (Tobias 1986; Belokobylskij 1989).

The relationship between *Ichneutes* Nees von Esenbeck and the Muesebeckiini is based largely on the nature of the sharply bent basal vein (1-M) of the fore wing, a feature not shared by other ichneutines such as *Ichneutidea* Ashmead and *Proterops* Wesmael. In *Mirax* Haliday, 1-SR generally forms a sharp angle with the parastigma, but the resemblance between this and the condition in ichneutines is superficial, and does not support the inclusion of Meusebeckiini in Miracinae. Mason (1969) lists six other characteristics shared by *Ichneutes* and Muesebeckiines, but none of these is unique to this clade. The Muesebeckiini lack the most significant synapomorphy of the microgastrine group of subfamilies (to which *Mirax* belongs); the placement of the spiracle in the membranous lateral portion of the first tergum. Additionally, the flagellomeres are not fixed in number as they are in Microgastrinae and Miracinae. On the basis of spiracular placement, we include miracines within the microgastrine group, and place Adeliinae and Ichneutinae (the latter including Muesebeckiini) with the Neoneurinae and Cheloninae as a sister-group of this clade. Meusebeckiines are most readily recognized by the venation pattern of the fore wing (Fig. 7).

The tribe Muesebeckiini is represented in Australia by the widespread genus *Parmigoneurus* Mueseheck. One species is described here, but others will

undoubtedly be found with more intensive collecting. As interpreted here, *Paroligoneurus* is a large genus, with numerous undescribed species in the New World. De Saeger (1944), working on the tropical West African fauna, has described the largest number of species, but propodeal differences suggest that at least some of his species belong elsewhere. Nixon (1965) previously noted the occurrence of *Paroligoneurus* in Queensland, but did not describe any species. Risbec (1951) described a species reared from Agromyzidae in Senegal, but this is an opiine. Known hosts of true *Paroligoneurus* are leaf-mining Lepidoptera. Muesebeck (1931) noted the close resemblance between *Oligoneurus* Szépligeti and *Paroligoneurus* in his original description of the latter. He differentiated the two solely on the basis of the relatively bare eyes and reduced number of flagellomeres in *Paroligoneurus*, but noted that *P. johnsoni* Muesebeck had a few scattered eye hairs. Subsequently, De Saeger (1944) described some species of *Paroligoneurus* with scattered eye hairs and Belokobylskij (1986) described a species of *Oligoneurus* with hairy eyes and relatively few (21-23) flagellomeres. Mason (1969) did not discuss either genus when he transferred them to Muesebeckiini, but presented a key to genera in which he separated *Oligoneurus* and *Paroligoneurus* on the basis of whether or not the eyes were hairy. Belokobylskij (1986) noted that previous characterisations were inadequate for distinguishing these two genera. He therefore added a clypeal character, and modified the traditional eye and antennal diagnosis. The moderately hairy eyes of the species described below further emphasize the weakness of this character state for separating *Oligoneurus* and *Paroligoneurus*, and we suggest that it should be abandoned entirely. Although the type species of *Oligoneurus* is very distinctive, with its large size, relatively large number of flagellomeres, carinate propodeum and petiole, and broad second tergum, other species which have been assigned to *Oligoneurus* possess only one or two of these traits, and otherwise resemble the type species of *Paroligoneurus*. A revision of the large Neotropical fauna is needed before the genera can be adequately defined. Until this can be accomplished, we believe that the best character for separating the two is the propodeal sculpture, admittedly a weak feature. The clypeus is evenly rounded in *Oligoneurus concolor* Szépligeti and *P. johnsoni* Muesebeck, and thus cannot be used for separating the two genera. Members of the distinctive Holarctic species-group with medially protruding clypeus more closely resemble *Paroligoneurus* than *Oligoneurus*, based on propodeal sculpture and the shape of tergite 2. The placement of two such species in *Oligoneurus* (Belokobylskij 1986) thus needs to be reassessed.



Figs 6–11. *Paroligoneurus pallidus* sp. nov., ♀ holotype. 6, antenna; 7, fore wing; 8, hind wing; 9, anterior view of head; 10, T1 and T2+3 of metasoma. 11, *Paroligoneurus pallidus* sp. nov., ♂ paratype, postero-dorsal view of metasoma showing medial pit in T6 and T7. Scales: Figs 6–8 – 0.5 mm; Figs 9–11 – 250 μm. Abbreviations for Fig. 6: length of antenna relative to body. h = heads; ms = mesosoma; mt = metasoma.

Paroligoneurus pallidus sp. nov.
FIGS 6–11

Material examined. Holotype: ♀, ANIC, Northern Territory, "12.06S 133.04E Cooper Ck, 19 km E by S of Mt. Borradaile, N. T. 9-10 Nov. 1972 J. C. Cardale". Paratypes: 6 ♀♀, same data as holotype (ANIC, TAMU, WARI); 8 ♀♀, 1 unknown sex, 12°40'S, 132°54'E, Magela Ck, 9 km SSE of Mudginberri H.S., 7-8.xi.1972, J. C. Cardale (ANIC, TAMU, WARI); 1 ♂, 12°27'S, 135°55'E, Ngarradj Warde Djobkeng, Kakadu Nat. Pk, 27.vi.1980, I. D. Naumann (ANIC). Queensland: 2 ♀♀, Iron Range, Cape York Pen., 26-31.v.1971, S. R. Monteith (ANIC); 1 ♂, same data except 1-9.vi.1971 (ANIC); 1 ♀, 15°03'S, 145°09'E, 3 km NE Mt Webb 30.iv.-3.v.1981, I. D. Naumann, ex ethanol, collected at light (ANIC); 2 ♂♂, Henrietta Ck, Palmerston Nat. Pk, 23.iv.1970, S. R. Curtis (ANIC); 1 ♂, 12°42'S, 143°20'E, 13 km ENE Mt Tozer, 14.vii.1986, J. C. Cardale, at MV light (ANIC); 1 ♂, 15°16'S, 144°59'E, 14km W by N of Hope Vale Mission, 7-10.v.1981, I. D. Naumann, ex ethanol (ANIC).

Female

Head. Frons bare medially, head otherwise densely setose; in dorsal view 2.05-2.20 × wider than maximum length, wider at eyes than at temples, in

lateral view eye 2.85-4.05 × longer than temple; height of head between apex of clypeus and base of antenna 1.0-1.2 × narrowest width of face; eyes hairy (Fig. 9); fronto-clypeal suture indistinct, clypeus thus not clearly separated from face; clypeus weakly convex in profile, ventral margin sharp, evenly convex, bearing a line of long erect setae; malar space short, in frontal view distinctly shorter than basal width of mandible; malar suture sharp, deep; antenna 18-segmented, slightly longer than body; flagellum broadest at middle, gradually narrowing apically and basally; first flagellomere 1.20-1.45 × longer than second; fifth flagellomere about 2.5 × longer than mid-width; labial palp 4-segmented, the third segment minute.

Mesosoma. Short and broad, 1.3-1.5 × longer than high, about as wide as high; pronotum laterally often collapsed in dried material, thus giving mesosoma the appearance of being depressed; mesonotal disc weakly convex, nearly flat; scutellum flat; mesonotum densely and uniformly covered with short setae and associated weak punctures; notauli absent externally, but visible internally as thin, dark streaks beneath pale integument; scutellum densely setose laterally, nearly bare medially; propodeum polished, unsculptured, covered with setae, these less densely spaced than on mesonotum; mesopleuron and metapleuron polished, unsculptured; hind femur broad, 2.6-3.0 × longer than mid-width.

Fore wing. Stigma very large, about 2 × longer than broad, roughly 2 × longer than metacarpus; r arising slightly distad of midpoint; fully sclerotised, pigmented portion of weakly curved r about half length of metacarpus, but distinctly longer than pigmented, sclerotised stub of 2−SR+M; anterior portion of basal vein sharply bent distally.

Metasoma. Petiole nearly flat, with very low weak dorsal carinae basad of spiracles, otherwise without sculpture; petiole broadest at spiracles, strongly narrowed towards base and apex, base and apex of approximately equal width, width at spiracles 1.5-1.8 × width at apex, length 1.1-1.5 × width at spiracles; T2 bare, polished, unsculptured, with trapezoidal median sclerite, its apex roughly 2 × wider than its base; T1 and T2 with broad weakly sclerotised areas between median sclerite and laterotergites; hypopygium large, about 2.4-2.5 × longer than petiole, gradually narrowing over posterior half to a weakly pointed apex; ovipositor sheath (total length) nearly 2 × longer than petiole (when dead), visible portion normally slightly longer than petiole, with ventral row of apical setae extending slightly more than half way towards base.

Colour. Yellow to orange; face varying from dark orange to variegated orange and brown; remainder of head and tip of metasoma usually brown; scape and pedicel, usually entire first flagellomere and sometimes base of second flagellomere yellow, remainder of antenna brown; ovipositor sheaths black.

Body length. 1.7-2.1 mm.

Male

As for female except as follows: median flagellomeres more slender, flagellum thus less obviously tapered towards apex, both T6 and T7 with a deep median pit (Fig. 11).

Referred material examined. Queensland, 1 ♀, 1 ♂, Bald Mtn area via Emu Vale (ANIC); 1 ♀, Bramston Beach (ANIC); 2 ♂♂, Brisbane (TAMU); 2 ♀♀, 3 ♂♂, 12 km NW Brisbane, (TAMU); 11 ♂♂, Bunya Mts (ANIC, WARI); 3 ♀♀, Camp Mountain (QDPI); 3 ♂♂, Iron Range (ANIC); 2 ♂♂, Mt Tamborine (QDPI); 2 ♂♂, Paluma Dam (ANIC), New South Wales, 2 ♀♀, Scotts Head, near Warrell Ck (ANIC, WARI).

Biology. Unknown.

Diagnosis. This species is readily recognised by its generally pale coloration, all congeners having distinctly darker bodies. The metacarpus is short relative to *P. johnsoni*, and the transverse radial vein arises nearer the midpoint of the stigma. The venation of *P. pallidus* thus more closely resembles that of the Afrotropical *P. wittei* De Saeger. Additionally, the ovipositor is longer than in all congeneric species. The antennae of the known Afrotropical species are 19- to 20-segmented, but the antennae are 18-segmented in both *P. pallidus* and *P. johnsoni*.

Discussion. The distinctly setose eyes of *P. pallidus* necessitate a clarification of the definition for *Paroligoneurus*. Mason's (1969) use of setose eyes for separating genera in the Mueseheckiini, and especially for separating *Oligoneurus* from *Paroligoneurus*, needs clarification. Nearly all species of *Paroligoneurus* have at least some setae on the eyes, and several short setae are readily visible medially on the eye of *P. johnsoni*, the type species. The number, size, and arrangement of setae constitute an important character set for species level discrimination in *Paroligoneurus*. Deep median pits, though not previously described, are found in a number of mueseheckiines. They are usually located on tergites 6 and/or 7, and occur in only males.

The type series of *P. pallidus* has been restricted to the material from Northern Territory and far North Queensland because of colour differences in the material from south-eastern Queensland. The more southerly specimens are generally darker, with most of the metasoma dark brown. However, there is some overlap, and there are insufficient representatives of both sexes from any one locality to adequately assess whether or not males are darker than females.

Subfamily Histeromerinae Fahringer

Comments: The monotypic, *Histeromerus* Wesmael, has been variously treated over the years. Until recently, most 20th century authors placed *Histeromerus* in the Doryctinae due to the presence of stout setae or pegs on the fore tibiae. Fahringer (1930) was the first to isolate it as a separate tribe within the Doryctinae. Van Achterberg (1976) initially transferred *Histeromerus* to the Braconinae, but soon realised that it was misplaced. Van Achterberg (1984) subsequently regarded it as a separate subfamily with a sister group relationship to Ypsistocerinae + Mesostoinae. This placement is based on the shared presence of a flattened petiole, compressed hind femora, and location of the metasomal spiracles in the epipleuron (van Achterberg 1984, 1988). Additionally, the transscutal articulation is absent. In the doryctine *Rhaptrocentrus* Marshall, however, the gaster is similarly shaped, with the spiracles located on the epipleuron. The hind femora are also flattened in *Rhaptrocentrus* (though generally not as much as in *Histeromerus*) and the venation is similar. The petiole shape and absence of the propleural flange, the epicnemial (=prepectal) carina, and the transscutual articulation are thus more useful features for separating *Histeromerus* from doryctines. Additional features are discussed by Quicke & van Achterberg (1990), who consider the Histeromerinae to be one of the most basal groups of Braconidae. The subfamily is readily recognised by the exceptionally long hind basitarsus, oddly shaped head with long temples and very short face, short antennae, and clavate fore tibia with stout setae clustered in a large patch along the dorsal (or outer) surface.

This is the first species of *Histeromerus* described from outside the Holarctic Region.

Key to known species of *Histeromerus*

1. Vein m-cu just antefurcal; fore tibia abruptly widened (Fig. 17) [Australia] ..... *H. clavatus* sp. nov.
   Vein m-cu postfurcal; fore tibia more gradually enlarged (Figs 18, 19) 2

2. Prosternum yellow; antenna with 15 or fewer segments; small species (about 2.5 mm in length) [Nearctic] ..... *H. canadensis* Ashmead
   Prosternum brown; antenna with 17-20 segments; larger species (at least 3.0 mm in length) [Palaearctic] ..... *H. mystacinus* Wesmael

Histeromerus clavatus sp. nov.
FIGS 12–17

Holotype: ♀, ANIC, Queensland, "12.43S 143.18E Qld, 11 km ENE Mt. Tozer 11-16 July 1986 J. C. Cardale Malaise trap/ethanol"

Female

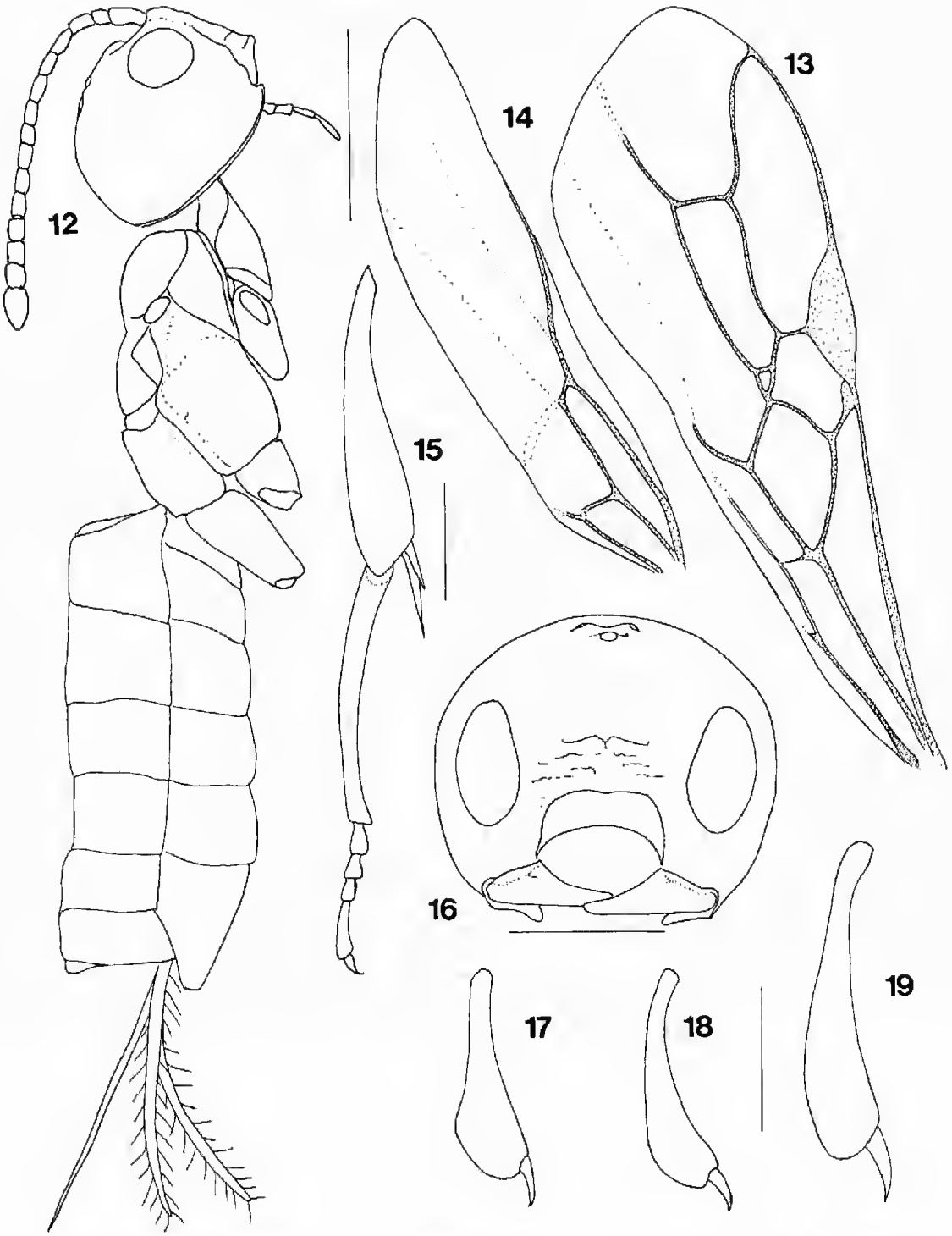
Head. 1.25 × broader than mesonotum (between tegulae); temples typically produced, in dorsal view 2.25 × longer than eye; malar space about half eye height; length of frons (between anterior ocellus and antennal socket) 1.7 × width of ocellar field; frons, vertex, temple and gena unsculptured; setae largely absent on gena, setal bases separated by length of setae on temple and vertex, more closely spaced on frons; face about equal in height to clypeus, about 4.3 × wider than high; face transversely strigose, with row of deep punctures laterally, extending through malar region; clypeus deeply punctate; antenna short, about equal in length to metasoma, 15 segmented; all flagellomeres with multiple placodes; palps 5- and 3-segmented; apical setae on labial palp longer than 3rd segment of palp.

Mesosoma. Pronotum in dorsal view a narrow unsculptured band; pronotum laterally weakly rugulose except along anterior margin; mesonotum without notauli; density of setae on anterior declivity similar to that on frons, less dense on median part of disc and largely absent laterally; scuto-scutellar sulcus unsculptured, without anterior demarcation, the mesonotal disc sloping gradually to form a depression along anterior margin of scutellum; propodeum unsculptured; mesopleuron bulging, strongly convex; subalar depression deep, narrow, unsculptured; mesopleuron lacking crenulate posterior margin; metapleuron weakly wrinkled dorso-posteriorly and ventrally.

Legs. As in other species of *Histeromerus;* hind femur more strongly compressed than mid femur; fore coxae broadly contiguous; hind coxa long, about 0.75 × length of hind femur; outer surface of fore tibia with short thick setae on its apical half; fore femur weakly grooved ventrally for reception of tibia, fore tibia abruptly broadened over apical half (Fig. 17), narrowing slightly from mid tibia to base; hind basitarsus very weakly curved, about 2 × longer than combined length of tarsi 2-5, slightly inflated over basal half.

Wings. Stigma short, broad, nearly hemispherical, about 2.4 × longer than broad; r vertical; 3–SR about 5.6 × longer than r, subequal to SR1; SR1 moderately curved, reaching metacarpus somewhat before wing tip; 2nd submarginal cell broader distally than proximally; m-cu antefurcal by about 0.3 × its length; cu-a postfurcal; CU1b completely absent, 1st subdiscal cell thus open at lower distal corner; M+CU1 tubular and pigmented except at extreme base; 1A+2A thickened in region of barely visible 2A; hind wing with 1-M about 1.1 × longer than M+CU; m-cu long, pigmented but spectral; 1r-m shorter than cu-a; R1 of hind wing distinctly shorter than SC+R1.

Metasoma. Petiole nearly flat, without dorsal or lateral carinae and associated pits; ovipositor strongly



Figs 12–19. *Histeromerus clavatus* sp. nov., ♀ holotype. 12, lateral view of body. 13, fore wing. 14, hind wing; 15, hind leg; 16, anterior view of head; 17, fore tibia. 18. *Histeromerus canadensis* Ashmead, ♀, fore tibia. 19, *Histeromerus mystacinus* Wesmael, ♀, fore tibia. Scales: Figs 12–14 = 0.5 mm; Fig. 15 = 375 μm; Figs 16–19 = 250μm.

compressed, blade-like, deeper basally, tapering distally, without obvious teeth; exserted portion about equal in length to mesosoma; ovipositor sheath densely setose, the setae longer than sheath width.

Colour: Dark brown; prosternum, anterior margin of pronotum, palps, first 4 antennal segments (largely), mid and hind coxae, tibiae, and all but extreme tip of tarsi yellow; fore coxae, mesosternum, and femora variously yellow-brown; ovipositor sheath whitish, with apical one-fifth brown; wings hyaline with infumate streak along 1-M; microtrichia on membrane very short and thick, giving wing a spotted appearance.

Body length: 2.4 mm.

Male
Unknown.

Biology: Unknown, but host records of previously described species indicate parasitism of coleopteran larvae in woody stems or bracket fungi.

Diagnosis: This species is most easily identified by its venation, with m-cu entering the first submarginal cell, the 1st subdiscal cell open in the lower distal corner through complete loss of CU1b, and the vertical position of r. Both *H. mystacinus* and *H. canadensis* have m-cu postfurcal, CU1b present at least as a stub, and r inclivous. The Australian species is otherwise very similar to *H. canadensis* and *H. mystacinus*, as noted above in the number of unique features used to define the subfamily. Both *H. clavatus* and *H. canadensis* are small species, with fewer flagellomeres and paler coloration than *H. mystacinus*. The apical setae on the palps are also longer and cu-a is postfurcal in the two smaller species.

Discussion: The holotype has a spurious vein in the second submarginal cell of the fore wing (Fig. 13). Anomalous venation has also been recorded for *H. mystacinus* (Marshall 1885, 1888). Marshall's specimen showed traces of a second recurrent vein (2m-cu), producing a pattern similar to that in *Apozyx* Mason. The latter however, has the petiole and prepectal carina more typical of doryctines than *Histeromerus*.

Subfamily Euphorinae Foerster

Comments: Shaw (1985) has provided substantial support for the clade composed of *Stenothremma* Shaw, *Wesmaelia* Foerster, *Chrysopophthorus* Goidanich, and *Aridelus* Marshall. Although all but *Wesmaelia* are well represented in Australia (Shenefelt 1969; Huddleston 1983; Shaw 1984; this study), *Chrysopophthorus* has not been previously reported from the continent (see Mason 1964), and until recently relatively few *Stenothremma* have been known. Additional information on these genera is presented here.

Stenothremma Shaw
FIG. 24

Comments: Amongst the most commonly encountered members of the Euphorinae in Australian collections are various species of *Stenothremma*. The genus was recently described from Australia and New Caledonia (Shaw 1984), based on three species. However, most Australian species are undescribed (e.g. approximately 20–30 new species in ANIC) and the material at hand considerably broadens the definition originally provided by Shaw (1984, 1985). Since *Stenothremma* is such a prominent member of the Australian euphorine fauna, and because males cannot be readily identified using existing keys, we take this opportunity to present additional morphological data. Hosts for *Stenothremma* are unknown, but two undescribed species (ANIC) have been swept from *Acacia* and *Eucalyptus*, respectively.

Shaw (1984, 1985) places *Stenothremma* within the *Aridelus-Wesmaelia-Chrysopophthorus* lineage, and provides a set of synapomorphies for this group. The most useful of these for identification purposes is the long, almost uniformly narrow (apical width less than 3 × basal width) petiole which is completely fused ventrally from base to apex. This feature, together with the completely developed, tubular SR1+3–Sr and 1–SR+M of the fore wing, are sufficient for placement of all Australian species in this lineage. The median frontal carina, which Shaw (1984) lists as a synapomorphy for this group of genera, is absent in some of the undescribed species of *Stenothremma* and weakly developed in others. It is more strongly developed in larger species.

Some New and Old World tropical species of *Meteorus* Haliday might be confused with members of the *Aridelus* lineage, and care must be taken to avoid this error. In these species, the apex of the petiole is often less than 3 × wider than the base. In all cases, however, the sides of the petiolar tergum are widely separated at least on the apical third. Additionally, as noted by Shaw (1985), the mandibles in *Meteorus* are broadly overlapping relative to the sickle-shaped mandibles of *Stenothremma*. The petiolar and mandibular characters are not always readily visible on pinned specimens. Within the *Aridelus* lineage, *Aridelus* is easily identified on the basis of the reticulate or reticulate-areolate sculpturing of the mesonotum. The mesonotum of *Stenothremma* varies from punctate to finely granular. Both *Wesmaelia* and *Chrysopophthorus* have M+CU1 at least partly desclerotised or absent. In all species of *Stenothremma*, M–CU1 is tubular throughout, and provides the most readily observed character for separation from these two genera (c.f. Figs 23, 24). Australian species of *Chrysopophthorus* known to us have the basal half of

the fore wing yellow, and M+CU1, though appearing weakly developed because of the pale coloration, is actually tubular over its basal and apical quarter, and nebulous only near its mid length. The Australian *Chrysopophthorus* are thus very similar to *Stenothremma*. Shaw (1984, 1985) has emphasised the compressed metasoma in defining *Stenothremma*, but this feature is not useful for males, and varies considerably in dried females, depending on the quality and manner of preservation (e.g. the metasoma of critical-point dried specimens is frequently bloated rather than compressed).

Shaw (1985) provides an excellent character set for analysis of euphorine phylogeny. Shaw's data for *Stenothremma* should be modified as follows, based on material available to us including all undescribed species:

Character 1, ocular setae: present in some species, absent in others.

Character 4, median frontal carina: extending nearly to anterior ocellus in some species, short and weak in others, absent in some.

Character 8, apical flagellomere: pointed in most species examined, but rounded in at least two species.

Character 15, malar suture: present in nearly all species examined, but weak and difficult to see in several.

Character 16, facial setae: variable among species, either obscuring face or not (as noted by Shaw (1984) in his original descriptions of the species, but not reflected in the coding for this character in Shaw (1985)).

Character 17, shape of lower clypeal margin: rounded (strongly convex) in most species, but nearly truncate in at least one species. The medially indented condition given by Shaw (1985) for other members of the *Aridelus* lineage does not hold for two of the Australian *Aridelus* species, and the indentation in the *Chrysopophthorus* species described below is barely perceptible. In these species, the clypeus varies from more or less truncate to convex.

Character 19, maxillary palps: 6-segmented in several of the species examined.

Character 25, legs: the difference between the legs of *Chrysopophthorus* and those of small yellow legged species of *Stenothremma* is very slight.

Character 26, mesonotal sculpture: varies from finely granular to finely punctate. The imbricate microsculpture of the mesosoma which Shaw (1984) noted as an unusual feature characterising *Stenothremma* is absent in a few species.

Character 36, metafemur length/width: short and broad in some species, moderately slender (length 5–6 × maximum width) in others, very long and slender (length greater than 6 × maximum width) in one species; both character states used by Shaw (1985) are therefore applicable.

Character 44, radial cell: the distance between the end of the radius and the wing tip is quite variable, and this variation is not adequately reflected in the character states used by Shaw (1985).

Character 62, tergite 2+3 length: the difference between *Stenothremma* and *Chrysopophthorus* are clearly evident in females, but considerably less so in males.

Character 65, lateral suture between tergites 2–3: this feature is present in at least the Australian species of *Chrysopophthorus*, although usually not as clearly evident as in *Stenothremma*. It is better developed in males than females.

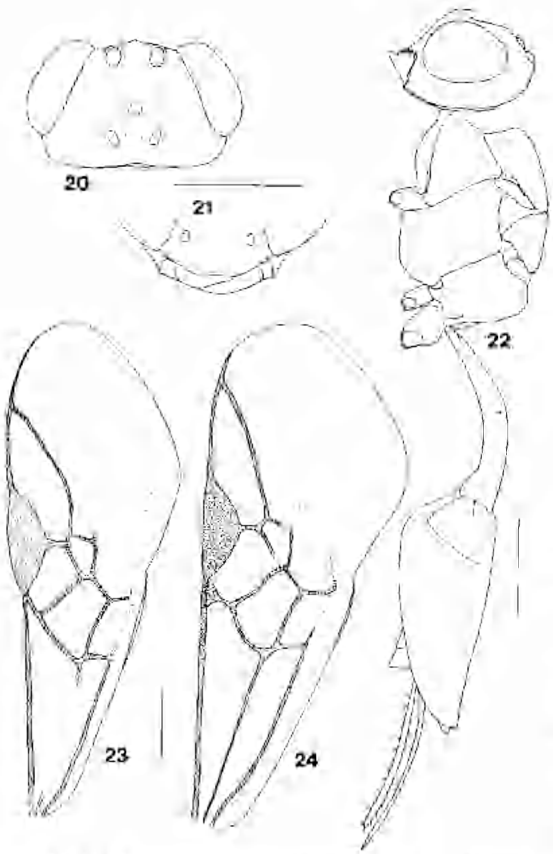
There is little doubt that *Stenothremma* belongs in the *Aridelus* lineage, and although its exact placement therein is now less certain, our analysis does support Shaw's (1984) hypothesis of relationships. Shaw (1985) treats *Stenothremma* as the sister-group of *Wesmaelia*+*Chrysopophthorus*+*Aridelus*. With the new data presented above, we find that two of the five characters supporting the *Wesmaelia*+*Chrysopophthorus*–*Aridelus* clade (numbers 17 and 19) do not hold, and the other three (numbers 62, 63 and 65) form a single character complex associated with terga 2–3. We treat this entire character complex as a cline, with the plesiomorphic state found in *Stenothremma*, and the apomorphic state found in *Aridelus*. The condition in females of *Chrysopophthorus* and *Wesmaelia* is definitely more like *Aridelus* than *Stenothremma*, and supplies the sole supporting feature for the *Wesmaelia*+*Chrysopophthorus*–*Aridelus* clade. The problem of using characters 1 and 36 to unambiguously support the *Wesmaelia*+*Chrysopophthorus* clade leaves the partially desclerotised M+CU1 as its strongest synapomorphy. *Aridelus* has a large number of autopomorphies (Shaw 1985), emphasising its separation from the other genera. However, the relationships among the other three genera are now less clear. Information on the hosts of *Stenothremma* may help solve this problem, for if the hosts are neuropteroid rather than hemipteroid, this would support a *Stenothremma* + *Chrysopophthorus* clade.

Chrysopophthorus hageni sp. nov.
FIGS 20–23

Material examined: Holotype ♀, ANIC, "SOUTH AUSTRALIA Adelaide Mar. 11-29, 1990 R. Wharton". Paratypes: 1 ♀, 3 ♂♂, same data as holotype (TAMU, WARI).

Female

Head. Transverse; in dorsal view 1.7 × broader than mid length; 1.4 × broader than mesonotum between



Figs 20–24. *Chrysopophthorus hageni* sp. nov., ♀ holotype. 20, dorsal view of head; 21, anterior view of lower head; 22, lateral view of body; 23, fore wing; 24, *Stenothrema* sp., fore wing. Scales = 0.5 mm.

tegulae; eyes bulging, in dorsal view 3.2 × longer than temples; temples convex, receding behind eye, densely covered with short decumbent setae; ocellar field small, widely separated from eye (Fig. 20); posterior ocelli separated by about 2.5 × their diameter; clypeus very broad (Fig. 21); apical margin thin, broadly and weakly truncate medially, very weakly emarginate centrally; smooth, nearly impunctate dorsally, weakly transversely aciculo-punctate along apical margin; face punctate medially, transversely striate just below antennal bases; frons, vertex, and temples punctate; punctures narrowly separated, almost coalescing medially on frons, more widely separated (1–3 × their diameter) on temples and vertex; malar space rugulose; antenna 21-segmented; first flagellomere about 5 × longer than wide; second flagellomere about 4.5 × longer than wide; fifth flagellomere about 1.4 × longer than wide; first flagellomere 2.6 × longer than fifth.

Mesosoma. Pronotum aciculate laterally; mesonotal disc punctate, punctures weak (shallow) and less densely spaced on lateral lobes than on median lobe, more densely spaced medially on anterior declivity than on disc; notauli crenulate, distinct though shallow; narrow anteriorly, converging and broadening posteriorly, the two sides separated posteriorly by a low median ridge; notauli not extending to prescutellar pit; scuto-scutellar sulcus with median ridge only slightly better developed than lateral ridges; scutellum covered with shallow punctures, lateral margins carinate only at extreme base; propodeum uniformly reticulate, without distinct carinae, shallowly excavated; mesopleural disc polished, with diagonal row of scattered punctures, otherwise smooth; precoxal sulcus shallow, punctate and irregularly alveolate.

Fore wing. Second submarginal cell subquadrangular; 2-SR and r-m separated at the radial sector by about 4 × their width; 3-SR nearly equal in length to r.

Metasoma. Petiole as long as mesosoma, 10.2 × longer than width at spiracle, slightly deeper at spiracles than at apex and base, width at spiracle about 1.5 × width at base; petiole without sculpture laterally; ovipositor sheath about 0.8 × length of petiole.

Colour. Yellow-orange; propodeum, metanotum and margins of scutellum variously brown to dark brown; T2 and apical one-quarter of ovipositor sheath dark brown to black; remainder of ovipositor sheath, ovipositor, petiole, legs, most of pronotum, clypeus ventrally, and most of mouthparts (except red mandibular teeth) white to yellow-white; antenna yellow basally, apical seven flagellomeres brown, darkening towards tip; fore wing venation yellow basad of stigma; stigma and veins bordering second submarginal cell brown; base of metacarpus yellow.

Body length. 3.3–3.4 mm.

Male

As for female except as follows: eye smaller, in dorsal view 1.8–1.9 × longer than temple; posterior ocelli separated by about 1.5 × their diameter; antennae 21- to 22-segmented; fifth flagellomere 2.6–2.8 × longer than wide; first flagellomere 1.3–1.6 × longer than fifth; scuto-scutellar sulcus with median ridge distinctly better developed than lateral ridges in 2 of 3 specimens; one male with distinct lateral carinae bordering median excavation of propodeum; 3-SR of fore wing absent or nearly so, the second submarginal cell decidedly petiolate in one specimen; petiole shorter, about 0.8 × length of mesosoma, 6.4–7.7 × longer than width at spiracle.

Referred material examined: A.C.T., 1 ♀, 1 ♂, Canberra (TAMU).

Biology. Unknown. Other members of the genus are parasitoids of adult Chrysopidae.

Diagnosis. This species runs to couplet 5 in Mason's (1964) key to species, based on the broad and very

shallowly emarginate clypeus. The distinctive sculpturing of the notauli, the polished median region of the mesopleuron, and the pattern of dark brown markings of the body readily separate this species from all previously described *Chrysopophthorus*. As Mason (1964) notes, *C. orientalis* Mason from Singapore has a number of unusual features. This Australian species shares none of these and is thus not closely related to *C. orientalis*.

Discussion: The two specimens from Canberra closely resemble those from Adelaide, but the female petiole is slightly shorter and the clypeus is more extensively punctate dorsally. We have seen an additional species from Queensland (ANIC), but as it is thus far known only from males, it is not described here. The species is named for Ken Hagen, in recognition of his contributions to chrysopid biology.

Subfamily Mesostoinae van Achterberg

Comments: This small endemic subfamily was previously known from only three species and very little material. Following recognition of the subfamily by van Achterberg (1975) and description of the first species, *Mesostoa compressa* van Achterberg from Perth, Quicke & Huddleston (1989) described a second species from Adelaide, *M. austini* Quicke & Huddleston. These authors also placed Tobias' monospecific subfamily Praonopterinae (Tobias 1988) as a junior synonym of Mesostoinae, but maintained *Praonopterus laevis* Tobias, from Jervis Bay, A.C.T. as a separate genus based primarily on differences in wing venation.

Members of the Mesostoinae show a general resemblance to some cyclostome braconids, particularly certain doryctines, exothecines and hormiines, but they can be usually separated from these taxa by the labrum being only slightly depressed, fore tibia evenly and finely setose, and antennal flagellomeres flattened. However, the species described below brings two of these characters into question, in that the labrum is strongly depressed and oval in shape and the mandibles are curved distally to form a subcyclostome mouth (Fig. 37), and the fore tibia has two rows of spines (Fig. 39). The recognition of these characters for *Mesostoa* requires further interpretation, but may indicate a much closer relationship with the Doryctinae than has previously been postulated (van Achterberg 1984; Quicke & van Achterberg 1990).

Key to known species of *Mesostoa*

1. Occipital carina absent; propodeum smooth, without medial longitudinal strigose sculpturing; scutum with only a trace anteriorly of a medial longitudinal groove (female antenna with 12 flagellomeres) ..... *M. compressa* van Achterberg

   Occipital carina present (Figs 34, 36); propodeum strigose in medial longitudinal line (Figs 31, 33); scutum with almost complete medial longitudinal groove (Figs 30, 32) 2

2. Ovipositor present (Figs 25, 26) (female) 3

   Ovipositor absent (male) 4

3. Antenna with 14 flagellomeres ..... *M. austini* Quicke & Huddleston

   Antenna with 19 flagellomeres (Fig. 26) ..... *M. kerri* sp. nov.

4. Posterior half of scutum with some longitudinal rugose striate sculpturing laterally, transscutal articulation present but faint ..... *M. austini* Quicke & Huddleston*

   Posterior half of scutum virtually completely smooth; transscutal articulation absent (Fig. 32) ..... *M. kerri* sp. nov.*

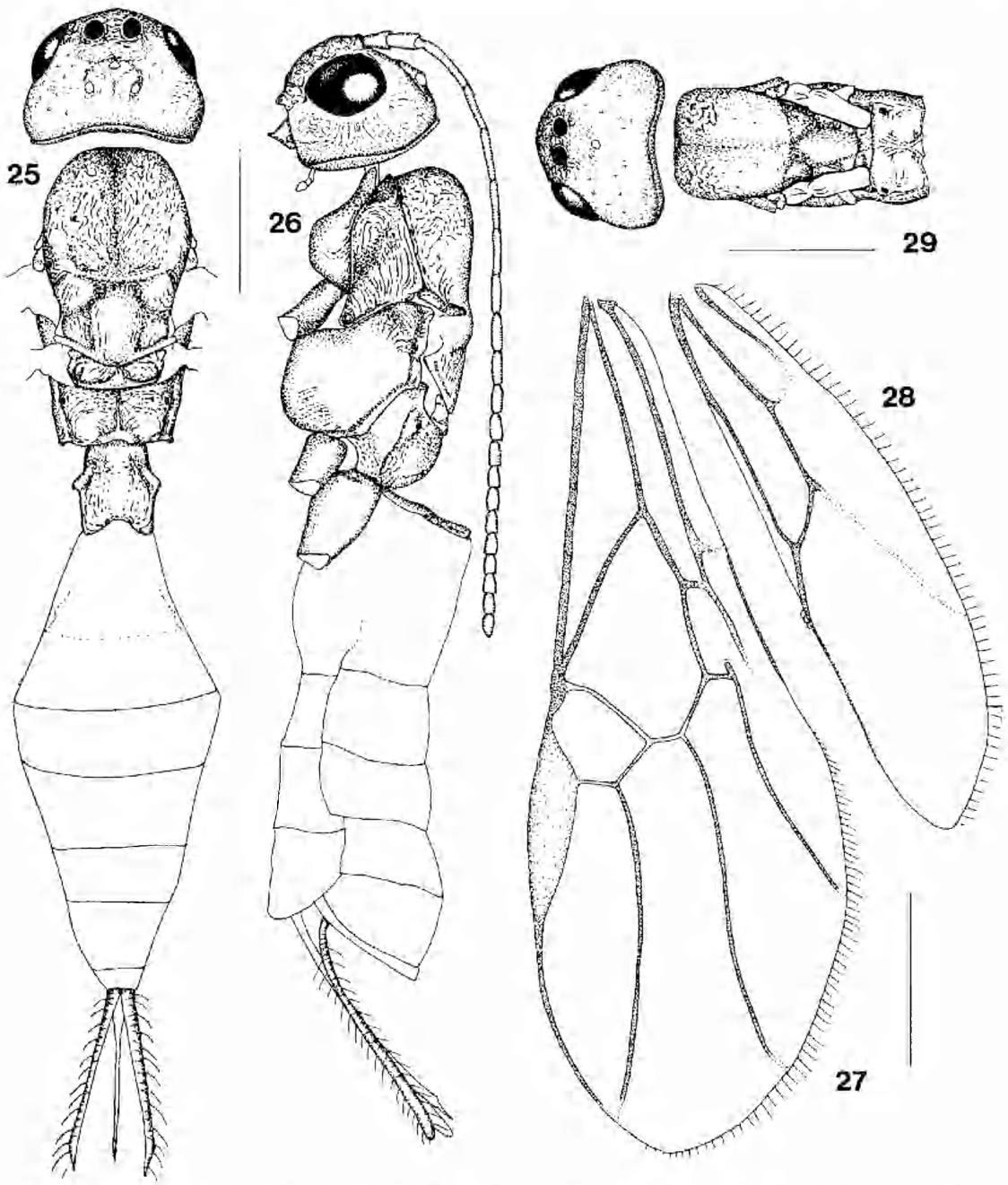
* males of both these two species have 18-19 flagellomeres.

Mesostoa kerri sp. nov.
FIGS 25–40

Material examined. Holotype: ♀, ANIC, South Australia: "S. Aust. Reedy Creek, 37.17S, 140.15E, 10th Oct.1991, Austin & Dangerfield ex twig gall of *Banksia marginata*". Paratypes: 52 ♀♀, 34 ♂♂, same data as holotype (2 ♀♀, 2 ♂♂ each in AEIC, ANIC, BMNH, CNCI, HNHM, QDPI, RNMH, USNM; 5 ♀♀, 5 ♂♂ TAMU; 31 ♀♀, 13 ♂♂, 2 of each gold-coated, WARI); 74 ♀♀, 38 ♂♂, S. Aust. Reedy Crk., 3.x.1953, emerged from galls on *Banksia* sp., dried from extended alcohol storage (10 ♀♀, 10 ♂♂ TAMU, 64 ♀♀, 28 ♂♂ WARI).

Female

Head. In dorsal view posterior part of head broadly emarginate, distinctly truncate so that angle between vertex and occiput is approximately 90°, occipital carina fine but complete throughout; vertex, temples and frons mostly smooth with very sparse short setae; ocellar triangle obtuse, area within and around triangle faintly strigose; ocelli of equal size; ratio of distance between posterior ocelli to shortest distance to eye margin 0.9:1.1 (Fig. 34); frons broadly depressed; widest part of head behind eyes i.e. temples extending laterally past line of eyes; face and malar region rugose to striate-rugose, with long scattered setae; face evenly convex, ratio of width of face to head (2.0:4.3); ratio of eye height to height of head (measured in midline from margin of labrum) (2.0:3.7); face slightly depressed at epistomal suture so that clypeus protrudes outwards slightly (best seen in antero-lateral view); lower margin of clypeus slightly convex and wrinkled; labrum depressed and oval in shape, mandible curved inwards in distal half to form subcyclostome condition (seen best in antero-ventral view); antenna with 19 flagellomeres, relative lengths of flagellomeres 1-4



Figs 25–29 *Mesostoa kerri* sp. nov., ♀ holotype. 25, dorsal view of body; 26, lateral view of body; 27, fore wing; 28, hind wing; 29, ♂, paratype, dorsal view of head and mesosoma. Scales – 0.5 mm.

(1.5:1.1:1.1:1.1), proximal 6-8 flagellomeres with very sparse setae, more distal flagellomeres becoming progressively more setose; distal 6-7 flagellomeres about 1.5 × longer than wide.

Mesosoma. Moderately dorso-ventrally flattened (seen in lateral view), about 2 × as long as high; scutum narrower than head, as wide as long, medial longitudinal line depressed to form a shallow groove extending almost to posterior margin of scutum, anterior part of groove smooth, posterior part with few

fine longitudinal striae merging with surrounding sculpturing; antero-lateral shoulders of scutum finely rugose, posterior margin smooth, rest finely rugose-striate in anterior part, narrowing into fine rugose-punctate tracts posteriorly which indicate position of notauli, outer side of these tracts bordered by smooth strip; whole surface covered with short setae; transscutal articulation distinct (Fig. 30); scuto-scutellar sulcus strongly curved posteriorly and faintly crenulate, this sulcus separating distinct subtriangular axillae; medial scutellum smooth with finely striate lateral borders, virtually hairless and oval in shape; lateral scutellum faintly strigose to smooth; propodeum with percurrent medial longitudinal band of fine strigose sculpturing, postero-lateral corners smooth, rest of propodeum very finely striate to rugose-striate, with some very fine background punctation (Fig. 31); in lateral view pronotum finely rugose medially surrounded by fine striate sculpturing extending to margins; mesopleuron smooth and bare except for rugulose epicnemial area; precoxal sulcus indicated by fine vertical striate sculpturing; metapleuron rugulose on ventral half, smooth dorsally; outer surface of fore tibia with irregular double row of spines (Fig. 39).

Wings. Generally the same as *M. austini* and differing from *M. compressa* in the fore wing as follows: 1–M broadly and faintly sinuate; anterior part of 1–SR+M bent; 2+3 –M slightly curved basally; subdiscal cell widening distally.

Metasoma. As long as head and mesosoma combined; petiole (T1) about as long as maximum width across position of spiracles, with fine longitudinal striae. T2+3 the largest tergite, about 0.6 × as long as T4–T7; suture between T2 and T3 indicated by fine transverse line; T2–T5 smooth with single transverse row of fine hairs; ovipositor and sheaths about one-third length of metasoma, sheaths with long sparse setae throughout.

Colour. Head and mesosoma dark brown to black; mandibles yellow with dark tip; legs brown with lighter bands at joints, femora slightly darker; metasoma and ovipositor sheaths dark brown to black with anterior sternites sometimes dark yellow-brown, wings hyaline, stigma pale.

Body length. mean 2.6 mm (range 2.3–2.9, n=15)

Male

Similar to female but differing as follows: length 2.3 (range 1.9–2.7, n=15); posterior ocelli minute (Fig. 36), sometimes absent; antenna with 19-20 flagellomeres; brachypterous (Fig. 29), fore wings rectangular, reaching to anterior margin of propodeum, base of wing darkly sclerotised, rest white in colour, membranous and without venation; hind wing minute, about half length of fore wing; mesosoma generally narrower; scutum broader and more truncate anteriorly, squarish at shoulders, smooth in posterior half; transverse scutellar suture absent (Fig. 32); medial scutellum more elongate; fore tibia without distinct spines on outer surface (Fig. 40); metasoma longer than head + mesosoma (6.0:4.3); T1 broader across position of spiracles than long (2.0:1.4); suture between T2 and T3 complete and membranous, these and other tergites subequal in length; T2–T6 smooth, with a few scattered minute hairs.

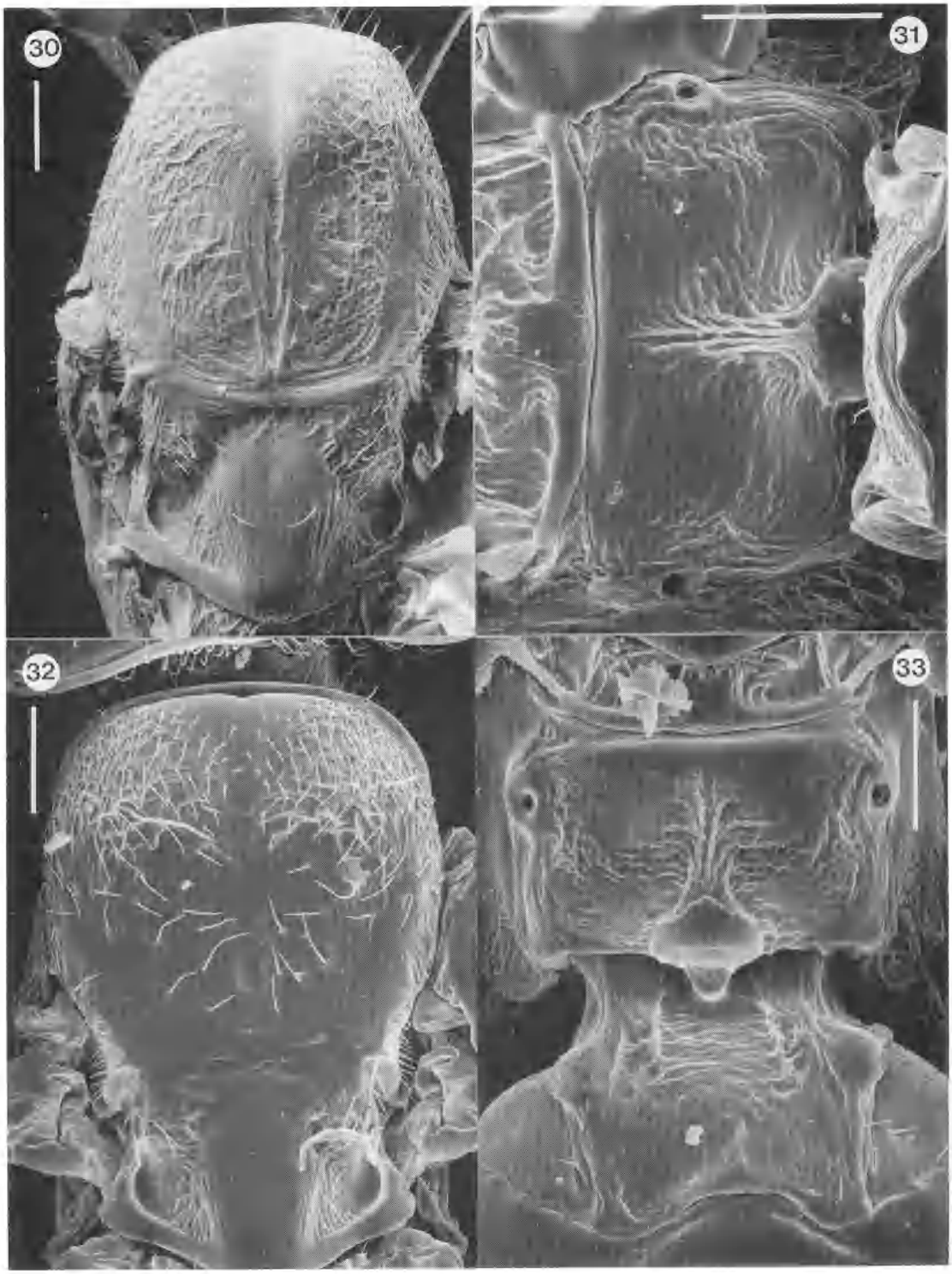
Referred material examined: Victoria, 4 ♀♀, 5 ♂♂, Melbourne, 7.x.1904, *Banksia* galls (BMNH)

Biology: This species is associated with galls on the outer branches of *Banksia marginata*, a relationship with this plant genus that may be general for all *Mesostoa* spp., given that *M. austini* has also been thus reared. However, the exact host is not yet known, but presumably it is the primary gall former or one of the several insects that inhabit *Banksia* galls, such as curculionid beetle larvae.

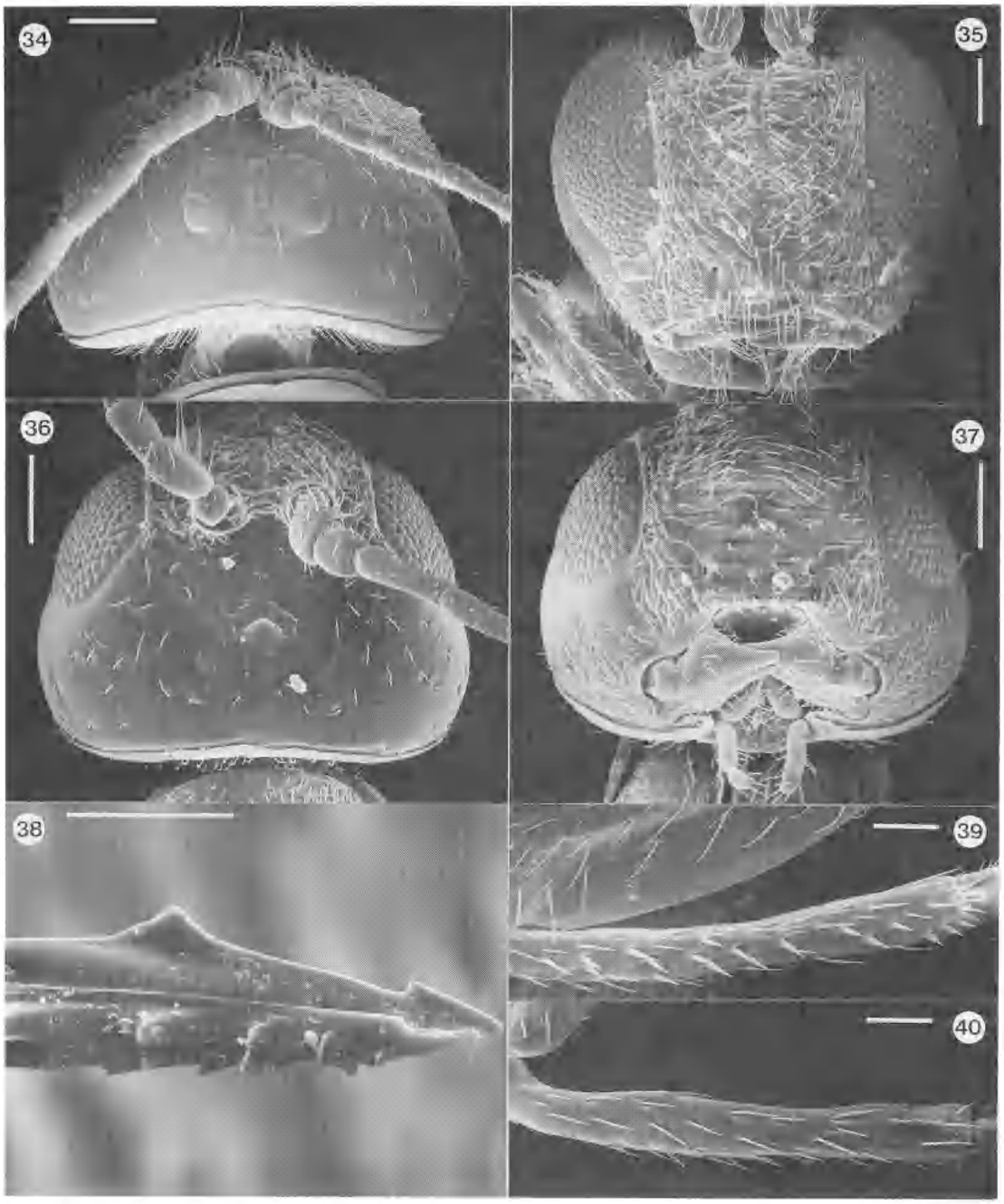
Discussion: This species is much closer to *M. austini* than it is to *M. compressa*. The latter species has the head and scutum more extensively sculptured with coarser curved striae. The scutum of *M. compressa*, although having the posterio-medial part flattened, lacks a longitudinal groove, the propodeum is smooth, the female antennae only have 12 flagellomeres, and the lateral fields of the scutellum are striate. In comparison, *M. austini* and *M. kerri* generally have the face rugose to rugose-striate and the scutum finely rugose-striate, the scutum with a longitudinal groove, the propodeum medially strigose, the female antennae with a greater number of flagellomeres, and the lateral fields of the scutellum smooth or faintly striate. *M. austini* and *M. kerri* differ substantially only in the number of antennal flagellomeres for the female and more subtly on the degree of sculpturing on the head and scutum, with *M. kerri* generally being less extensively sculptured.

As pointed out by Quicke & Huddleston (1989) the presence or absence of an occipital carina is often used as a primary distinguishing character at the generic level, and in this respect there is some justification for placing *M. austini* and *M. kerri* in a separate genus from *M. compressa*. However, until more material of this rare subfamily becomes available there is little or no advantage in arranging the four known species of Mesostoinae in three separate genera.

This species is named after Professor Allen Kerr, inaugural head of the Department of Crop Protection at the Waite Institute, and one of Australia's leading scientists.



Figs. 30–33. *Mesostoa kerri* sp. nov., ♀, paratype. 30, dorsal view of scutum and scutellum; 31, dorsal view of propodeum. 32, 33. ♂, paratype. 32, dorsal view of scutum and scutellum; 33, dorsal view of propodeum and T1. Scales = 100 μm.



Figs 34–40. *Mesostoa kerri* sp. nov., ♀, paratype. 34, dorsal view of head; 35, anterior view of head. 36, 37, ♂, paratype. 36, dorsal view of head; 37, antero-ventral view of head (N.B. transverse lines on face are due to specimen charging). 38, 39, ♀, paratype. 38, tip of ovipositor; 39, fore tibia. 40, ♂, paratype, fore tibia. Scales: Figs 34–37 = 100 μm; Figs 38–40 = 50 μm.

Subfamily Meteoridinae Capek

Comments: This small subfamily is defined by its biology (gregarious larval-pupal endoparasitoids of Lepidoptera) and highly modified metasoma (Nixon 1941). Capek (1970) separated the nominate genus, *Meteoridea* Ashmead, from the Diospilini on the basis of larval morphology and biology, and placed it in a subfamily of its own. Until recently only two genera had been described, *Meteoridea* and *Benana* Nixon. Shenefelt & Muesebeck (1957) redescribed the previously poorly characterised *Meteoridea*, and synonymised *Benana* with it. This synonymy was accepted by Capek (1970). Van Achterberg (1984), however, implied that the two were distinct, but has since reversed his opinion (van Achterberg 1990). In addition to the Australian species described below, we have examined material of *Meteoridea* from West Africa and North America. In North American material, the median lobe on the apical margin of the clypeus is more tooth-like than in the Australian and West African species. Additionally, the deep basal pits of the petiole (dorsope) are more laterally displaced in North American species, and not visible in dorsal view. However, we do not consider these differences sufficiently clear-cut for separating *Benana* from *Meteoridea*. Van Achterberg (1990) has recently described a third genus of Meteorideinae from New Zealand, *Pronkia* van Achterberg, which has a number of unusual features that align it, at least superficially, with the Agathidinae and Sigalphinae. *Pronkia* differs substantially from *Meteoridea* in that it has a smooth propodeum, dorsope absent, fourth tergite depressed, fore wing vein 1–SR present and vertical, r short, M+CU1 unsclerotised, and hind wing marginal cell slender.

The species of *Meteoridea* described here is the first record for the subfamily from the Australian continent. Although van Achterberg (1984) has previously stated that the Meteorideinae are "restricted to the (sub)tropics," the description of *M. compressiventris* Shenefelt & Muesebeck from Wisconsin, U.S.A. (Shenefelt & Meusebeck 1957) and *P. antefurcalis* van Achterberg from New Zealand, clearly show that the subfamily extends into more temperate regions.

Meteoridea anic sp. nov.
FIGS 41–44

Material examined. Holotype: ♀, ANIC, Queensland, "15.03S 145.09E 3km NE Mt. Webb 1-3 Oct. 1980 Q J. C. Cardale ex ethanol". Paratypes: 3 ♀♀, 15°04'S, 145°07'E, Mt Webb Nat. Pk., 28-30.ix.1980, J. C. Cardale, ex ethanol (ANIC, WARU); 5 ♀♀, 15°17'S, 145°10'E, 5km W by N Rounded Hill in Hope Vale Mission, 7.x.1980, J. C. Cardale, ex ethanol (ANIC, TAMU, WARU); 1 ♀, 1.5 km SE Kuranda, 16.v.1980, J. D. Naumann & J. C. Cardale (ANIC).

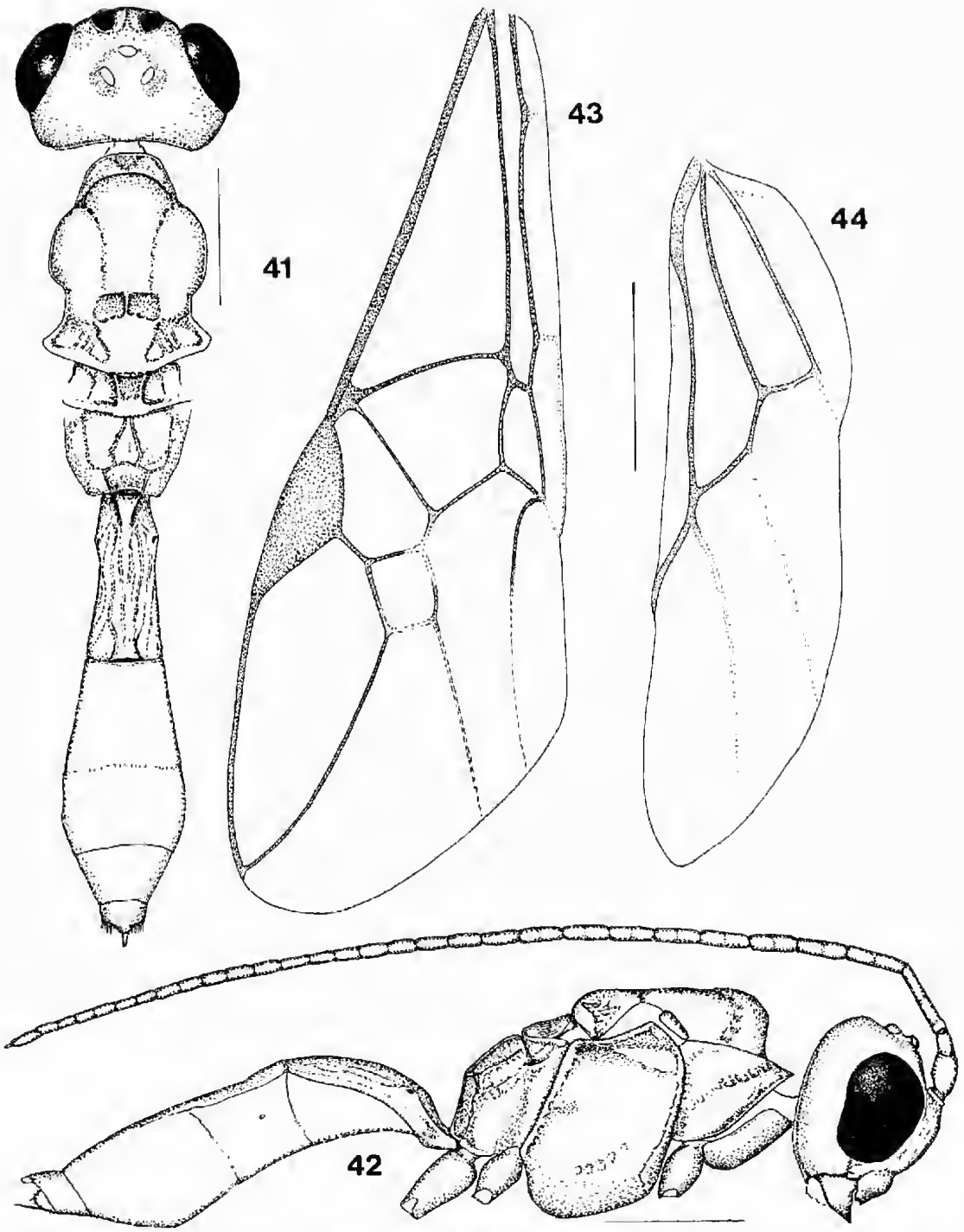
Female

Head. In dorsal view wider than scutum; temples broad; eyes bulbous and glabrous; ocelli forming a compact triangle, distance between posterior ocelli much shorter than distance from them to margin of eye; occiput, vertex, frons and temples smooth and shining, except for few tiny punctures associated with occasional fine setae; head in anterior view almost circular; face strongly convex, with broad medial longitudinal ridge and scattered punctures associated with long fine setae; epistomal suture impressed; clypeus convex with scattered punctures and slightly up turned lower margin; malar space small, margin adjacent to mandible slightly convex; antennal sockets with raised margins; antenna 31-segmented, all flagellomeres longer than wide, reaching as far as posterior edge of metasoma.

Mesosoma. Pronotum with large dorsope, in lateral view with medio-diagonal line crenulate, posterior and ventral margins crenulate; scutum smooth with occasional scattered punctures and associated fine setae; notauli percurrent and crenulate, anterior declivous portions broadly crenulate; transscutal articulation straight; scuto-scutellar sulcus comprising 2 or 3 deep foveae; scutellum convex, smooth and shiny, except for a few scattered punctures and associated long setae; lateral fields of scutellum faintly striate; posterior margin of scutellum smooth though sometimes with faint medial rugosity; metanotum with 2 prominent medial longitudinal carinae and less distinct carinae laterally, propodeal carinae sometimes somewhat irregular but always forming a distinct areola and enclosed lateral and posterior areas which are punctate or rugose-punctate; surface of propodeum and metapleuron covered with long fine setae; precoxal sulcus and pleural suture faintly crenulate; flange above epicnemial area carinate (see van Achterberg 1979), margined by crenulate or foveolate impressions.

Wings. Fore wing with vein 1–M slightly bowed, r emerging from mid point of stigma; CUla strongly arched basally; subbasal cell narrowed slightly at middle; subdiscal cell widened distally; hind wing 1–SR and 2–M indicated by short pigmented spurs basally, rest of these veins desclerotised; M+CU 3 × as long as 1–M; 1–1A desclerotised.

Metasoma. Almost as long as head and mesosoma combined; petiole (T1) slightly constricted behind spiracles then widening slightly to posterior half, widest across posterior margin, 2.5 × longer than wide, with distinct antero-lateral pits, dorso-lateral margins distinctly carinate, dorsal surface longitudinally striate with punctate to rugose-punctate background sculpturing; T2 and all other metasomal tergites smooth and shiny with occasional scattered hairs concentrated laterally and on posterior tergites; posterior most tergite somewhat extended distally and



Figs 41–44. *Meteoridea anic* sp. nov., ♀, holotype. 41, dorsal view of body; 42, lateral view of body; 43, fore wing; 44, hind wing. Scales = 0.5 mm.

laterally to form a capsule enclosing ovipositor; ovipositor and sheaths hidden.

Colour: Body including legs uniformly yellow; scape and pedicel yellow, flagellomeres brown; mandibles darkened distally; wings hyaline, venation evenly coloured, stigma translucent yellow-brown.

Male
Unknown.

Biology: Unknown.

Diagnosis: The uniformly yellow body separates this species from all but *M. testacea* (Granger) from Madagascar. It is nearly identical to the latter, differing only in minor sculptural features of the petiole.

Subfamily Helconinae Foerster

Comments: The helconines represent a rather diverse assemblage of taxa which, even in the strict sense (i.e. with the removal of *Cenocoelius* Haliday into a separate subfamily – Szépligeti 1902), may still be polyphyletic or at best paraphyletic (Quicke & van Achterberg 1990). Van Achterberg (1983) recognised four tribes; Helconini Ashmead, Brulleiini van Achterberg, Diospilini Foerster and Brachistini Foerster, all of which are represented in the Australian fauna (Brulleiini only by undescribed species). Of these the Helconini is the most diverse, with four of five recorded genera endemic to Australia. *Helcon* Nees von Esenbeck is virtually cosmopolitan in distribution, while *Australhelcon* Turner, *Parahelcon* Kokujev, *Trichohelcon* Turner and *Calohelcon* Turner are known only from mainland Australia and Tasmania. Collectively, they are represented by nine described species, with the first three genera not having been treated since their original descriptions (Kokujev 1901; Turner 1918). *Calohelcon* has recently been redescribed and discussed by Quicke & Holloway (1991). The tribe Helconini has been defined by the presence of the following characters: frons with a medial longitudinal carina (lamella), hind femur rugose ventrally, propodeal spiracle situated medially, and fore wing veins 1–SR and 2A present (van Achterberg 1983). As is true of many of the Australian helconines which have been placed in the Helconini, *Calohelcon* is unusual in several respects. The species of *Calohelcon* and *Trichohelcon* which we have examined have a very smooth body and so lack a precoxal sulcus and carinate or rugose propodeum. *Calohelcon* is particularly remarkable in that the first metasomal tergite is enlarged so as to appear inflated (Figs 48, 51). Quicke & Holloway (1991) also state that *Calohelcon* has retained a number of plesiomorphic characters, in particular a large number of hamuli, the presence of hind wing vein m-cu, and the presence of a costal cell in the fore wing. Clearly, the definition of Helconini used by van Achterberg (1983) must be reassessed in the light of the Australian fauna, but this cannot be accomplished until the rich helconine fauna of this continent has been more thoroughly described.

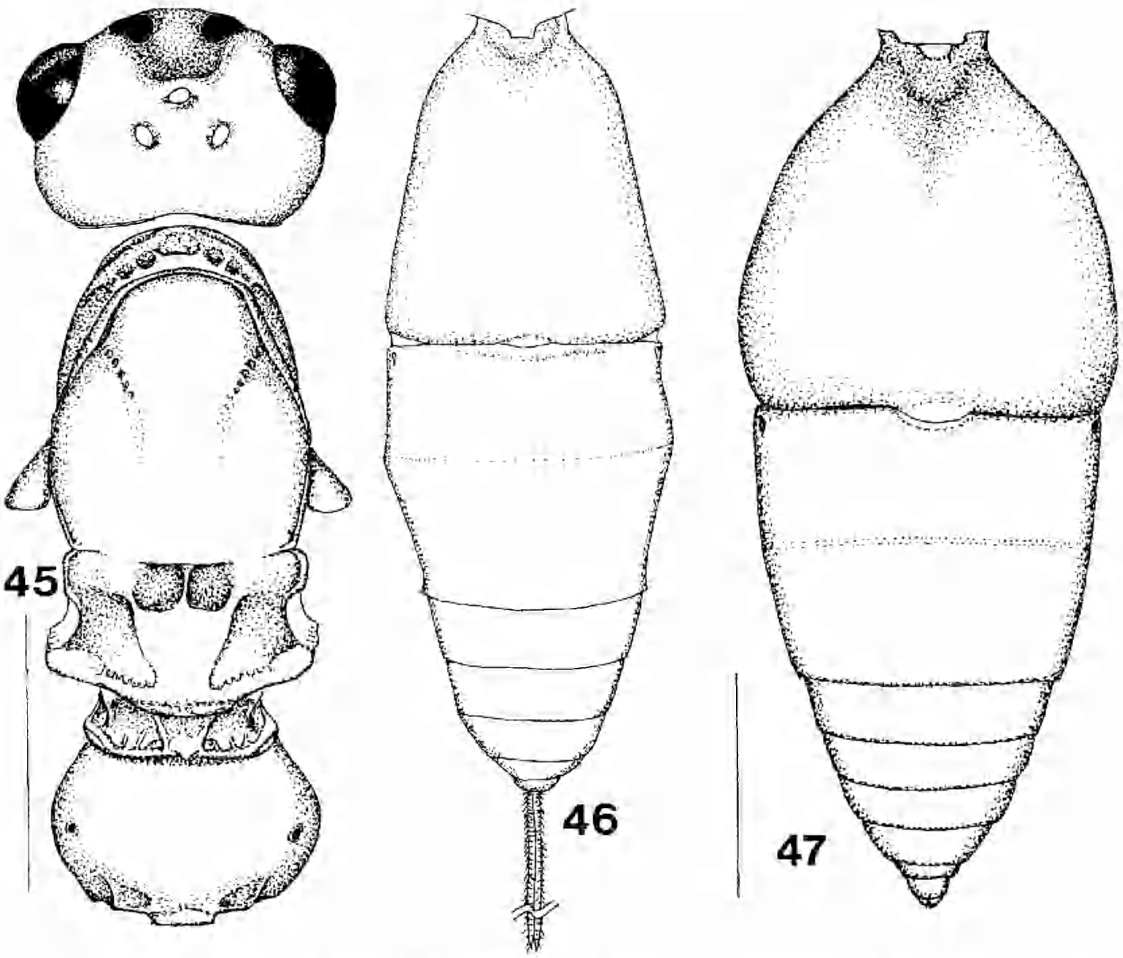
We describe below a third species of *Calohelcon* from central Australia, where the genus has previously been known only from the eastern coastal margin of the continent. The inclusion of this species extends the limits of the genus slightly and requires the diagnosis of *Calohelcon* presented in Quicke & Holloway (1991) to be modified as follows: frons with median longitudinal carina varying from well-developed to reduced or nearly absent; propodeal spiracle circular or slightly elliptical; fore wing with costal cell open for about two-thirds of length of veins C and Sc+R+Rs to almost closed over; hind wing with vein m-cu present or absent; hamuli number variable (5-9); ovipositor as long as or longer than body. *Calohelcon* shares a number of features with *Trichohelcon*, but is readily separated by the inflated, nearly bare first metasomal tergite.

Host records for the Helconinae show that they have only been reared as endoparasitoids of coleopteran larvae. We treat with scepticism the record for *C. obscuripennis* Turner in Quicke & Holloway (1991) (1 ♀, ANIC "probing tree trunk with cossid larvae") as evidence that the host biology of this genus departs from that known for other helconine genera. In our experience, *Eucalyptus* and *Acacia* trees can be heavily infested with both coleopteran and lepidopteran larvae, and so observed ovipositor probing is likely to be inaccurate as a method of associating potential hosts.

Key to known species of *Calohelcon*

1 Dorsal surface of T1 in lateral view convexly rounded in anterior part and flattened posteriorly (Fig. 48); ovipositor longer than body; body 8 mm in length or shorter ..... *C. clangerfieldi* sp. nov.
Dorsal surface of T1 in lateral view with large hump in anterior half and weakly rounded posteriorly (Fig. 51); ovipositor as long as body; body about 13 mm in length or longer 2

2 Lateral margins of T1 in dorsal view constricted in anterior part; scutum and T5–T9 black, wings yellowish basally, grey-brown apically ..... *C. obscuripennis* Turner
Lateral margins of T1 in dorsal view only slightly constricted in anterior part; scutum and T5–T9 orange, wings evenly light brown ..... *C. roddi* Quicke & Holloway



Figs 45–47. *Calohelcon dangerfieldi* sp. nov., ♀ holotype. 45, dorsal view of head and mesosoma; 46, dorsal view of metasoma; 47, ♂, dorsal view of metasoma. Scales: Fig. 45 = 0.8 mm; Figs 46, 47 = 0.75 mm.

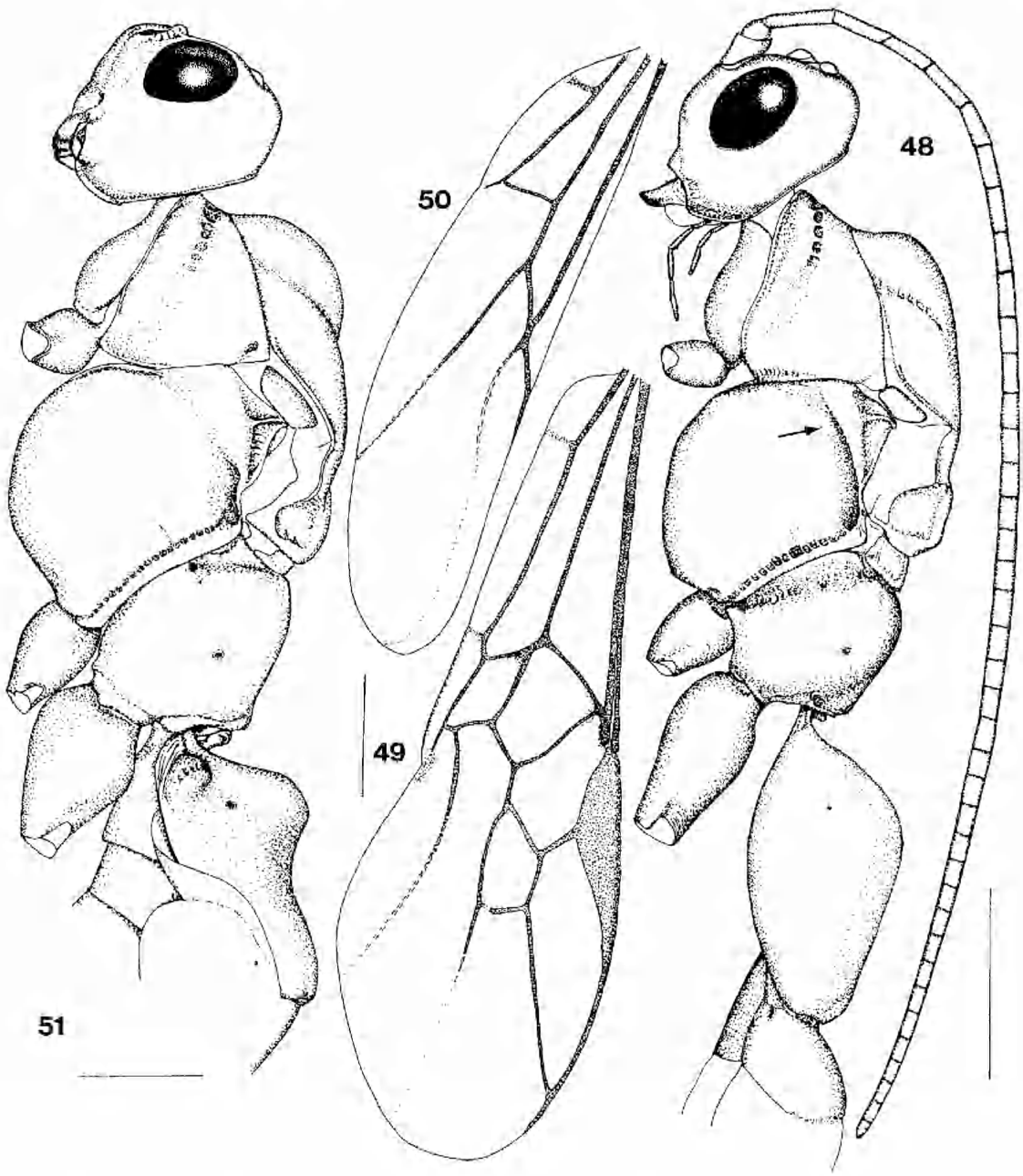
Calohelcon dangerfieldi sp. nov.
FIGS 45–50

Material examined. Holotype: ♀, AEIC, Northern Territory, "Yuenduma N.T., Australia August", no collector or date given.

Female

Head. Completely smooth and shiny; temples and face with minute punctures and associated fine setae; vertex and frons virtually bare; in dorsal view occipital carina angled slightly so as to be obtusely pointed medially; in lateral view occipital carina extending ventrally to meet hypostomal carina; ocelli forming equilateral triangle, distance between posterior ocelli slightly less than distance from them to eye margin (2.0:2.3); in anterior view vertex convexly rounded so that lateral ocelli are above dorsal margin of the eyes; face evenly convex, node between antennal sockets extending dorsally into short faint carina which fades out before reaching frons; eyes more than half height of head (2.5:4.0 – measured in lateral view from vertex to base of mandible); malar sulcus absent; clypeus moderately transverse, slightly less than 2 × wider than long; mandibles short, only overlapping slightly; antennae reaching to about midpoint of T2+T3, 41-segmented

Mesosoma. Slightly narrower than head; pronotum well exposed dorsally, coarsely crenulate around pronope, crenulate line fading on smooth lateral pronotum, latero-anterior margin of pronotum finely crenulate; scutum, scutellum and propodeum smooth and shiny, with a few scattered fine setae; antero-lateral margins of scutum slightly emarginate at point of notauli; notauli crenulate and reaching posteriorly to about middle of scutum; scutellar sulcus developed as 2 deep foveae; flange above epicnemial area carinate



Figs 48–51. *Calohelcon dangerfieldi* sp. nov., ♀ holotype. 48, lateral view of head, mesosoma and anterior metasoma (carinate flange above epicnemial area, arrowed); 49, fore wing; 50, hind wing. 51. *Calohelcon obscuripennis* Turner, ♀, lateral view of head, mesosoma and anterior metasoma. Scales: Figs 48–50 = 1.0 mm; Fig. 51 = 1.5 mm.

(Fig. 48, arrowed) and reaching anteriorly to touch dorsal part of prepectal carina.

Wings. Costal cell of fore wing indistinct; m-cu much shorter than 1−M so that discal cell narrows distally; 1−SR+M sinuate; 1−SR very short almost obliterated; 2−SR+M 0.67× as long as 2−SR; 3−SR as long as r-m; SR−1 straight; hind wing without vein m-cu arising from 2−M; R1 with 5 hamuli.

Metasoma. T1 longer than T2+T3, in dorsal view broadening posteriorly, with broad shallow medial longitudinal depression in anterior one third, lateral margins virtually straight, in lateral view convexly rounded in anterior part and flattened posteriorly, lacking large antero-lateral pits; suture between T2 and T3 faint; ovipositor longer than body (7.5:6.0).

Colour. Head, mesosoma including coxae and T2−T8 orange-brown; antennae and legs black; latero-anterior half of pronotum black; propleura yellow-brown; wings evenly and darkly infuscate; T1 white; S1 white with 2 broad dark transverse bands; laterotergites of T2 and T3 and posterior sternites black; ovipositor brown, sheaths black.

Body length. 7.0 mm, not including ovipositor.

Male

As for female except as follows: slightly larger in size, body length 8.0 mm; T1 larger, in dorsal view wider than rest of metasoma, lateral margins rounded; 2−SR+M of fore wing almost as long as 2−SR; costal cell slightly more obvious; flange above epicnemial area not reaching anteriorly as far as dorsal part of prepectal carina, lateral pronotum more extensively black, anterior mesopleuron and distal half of all coxae black.

Biology: Unknown.

Referred material examined: South Australia, 1♂, Dalhousie Springs, 29×83, G. A. Holloway (ANIC).

Diagnosis: This species is most easily identified by the shape of T1, the crenulate notauli, lack of medial sculpturing and a carina on the face and frons, shape of the pronotum (in lateral view), fore wing venation, number of hamuli and length of the ovipositor. Although this is the first record of a male for the genus, we have not included the single male specimen in the type series because there is a possibility that the slight differences between the sexes described here are representative of two species, not intraspecific sexual dimorphism. Until more material becomes available this problem will not be satisfactorily resolved.

Etymology: This species is named after Paul Dangerfield in recognition of the illustrations he has prepared for us.

Subfamily Alysiinae Stephens

Comments: In a recently published paper by the authors revising the Australian members of the Tribe Dacnusini (Wharton & Austin 1991), several type-setting errors were overlooked which could result in significant taxonomic confusion. We therefore take this opportunity to correct the most serious of these, as follows: 1) p. 198, line 30, subheading "*'Chaenusa nigricapitis'*" should read "*'Chorebus nigricapitis'*"; 2) p. 201, line 50 "1 or 2" should read "1 of 2"; and 3) p. 205, line 17, "*areolis*" should read "*areolaris*".

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